Fault-Attention Generative Probabilistic Adversarial Autoencoder for Machine Anomaly Detection

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Abstract

Anomaly detection is one of the most fundamental and indispensable components in predictive maintenance. In this article, anomaly detection is modeled as a one-class classification problem. Based on the scenario that the training data only include healthy state data, a fault-attention generative probabilistic adversarial autoencoder (FGPAA) is proposed to automatically find low-dimensional manifold embedded in high-dimensional space of the signal. Benefited from the characteristics of autoencoder, the signal information loss in feature extraction is reduced. Then, the fault-attention abnormal state indictor can be constructed with the distribution probability of low-dimensional feature and reconstruction error. Effectiveness of the model is verified with fault classification datasets and run-to-failure experimental datasets. The results show that FGPAA outperforms both GPAA and other traditional methods and can be processed in real time. It not only can obtain high accuracy for both classification data and run-to-failure data, but also achieve a certain trend index for run-to-failure data.